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Calvatia oblongispora sp. nov. from Brazil, with close affinities to *C. sporocristata* from Costa Rica

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Abstract — A new species of *Calvatia* from Manaus in Amazonas State, Brazil, is proposed, which is very close to *Calvatia sporocristata,* recently described from Costa Rica. The two species have been compared macroscopically and examined using light and scanning electron microscopy. The proposed new species, *C. oblongispora,* possesses a distinctly two-layered exoperidium consisting of a hyphal outer layer and an inner pseudoparenchymatous layer. This contrasts to the single pseudoparenchymatous exoperidium possessed by *C. sporocristata*. A table comparing the main exoperidial, basidiospore, and capillitial differences between both species is provided.

Key words — *Lycoperdaceae,* taxonomy, morphology, SEM, gasteromycetes

Introduction

During a taxonomic survey of the species of *Calvatia* from South America, a collection from INPA, at Manaus, State of Amazonas, Brazil, was studied that we were unable to match with current reference publications (Zeller & Smith 1964 Kreisel 1992, 1994; Lange 1990, 1993; Moreno & al. 1996 Ochoa & al. 1998 Calonge & al. 2003). In their study of phylogenetic relationships among the *Lycoperdaceae* from North Europe, Larsson & Jeppson (2008) included six species of *Calvatia* in their sequence data analyses. [The current (10th) edition of the Dictionary of the Fungi (Kirk & al. 2008) recognizes about 40 taxa.]

Materials and methods

For the study of the gastrocarp, basidiospores, and capillitium, we followed the methods described by Wright & Suárez (1990). Scanning electron micrographs were taken using a Phillips SEM 515 belonging to the Centro de Investigaciones Tecnológicas de las Fuerzas Armadas (CITEFA) and a Hitachi S-3000N SEM

belonging to Real Jardín Botánico de Madrid (CSIC). Examinations under the light microscope (LM) followed standard techniques using 5% KOH solution as the moisturizing agent. Herbarium abbreviations follow Holmgren & al. (1990).

Results

Calvatia oblongispora V.L. Suárez, J.E. Wright & Calonge **sp. nov.** (Figs. 1a, d)
MycoBank MB513105

Gastrocarpus globosus vel subglobosus, ca. 8–10 cm diam. Peridium bistratosus, tenue, facile secedentibus, fragilissimus, laeve, compactus, flavus vel ochraceus, rugosus, rhizomorphus mycelianus ornatus, usque ad 5 mm long. Gleba gossipino-compacta, ad centrum brunneo-flava, versus peridium concoloribus. Subgleba alveolata, prominens, concoloribus, ca. 2.5–3 cm alt.

Sporis cylindrico-ellipsoideis vel longe ovoideis, hyalinis, echinulatis, 5.4–7.5 × 3.6–4.3 µm, mucronatis, mucro 1 µm long, ornamentatione sub SEM echinulis in cristae anastomosantibus meridianis exornatis.

Holotypus: *Brazil: Amazonas, Manaus, leg. Singer nº 10.605, 4-II-1978 in herb. INPA nº 82-826 conservatus est.*

Basidioma globose to subglobose, ca. 8–10 cm diam. Peridium thin, easily detachable from the gleba, fragile, crumbling, smooth, tightly felty-appressed, light beige, wrinkled, with a small, short, thin mycelium cord, 5 mm long; double, formed by two distinct layers: a) exoperidium, with an outer hyphal layer, 50–100 µm thick, formed by hyaline, intertwined, septate, branched hyphae, without pores, up to 7 µm thick, and an inner one of pseudoparenchymatous, hyaline, thin-walled cells, 13.5–54 × 13.5–40.5 µm; b) endoperidium formed by septate, dichotomously branched hyphae without pores, 1.5–7.2 µm diam, walls up to 0.7µm thick. Gleba cottony subcompact, with light yellow to brownish yellow centre. Subgleba cellular, prominent, concolorous with the glebal centre, ca. 2.5–3 cm high.

Spores cylindrico-ellipsoid, hyaline, echinulate, uniguttulate, 5.4–7.5 × 3.6–4.3 µm. The ornamentation appears as spines arranged along longitudinal cristae in single or dichotomous fringes, other times in less obvious meridian disposition (Fig. 1a) Capillitium light brown, formed by fragile, profusely septate threads, breaking at the septa, with blunt ends and with irregularly and variously sized pores (Fig. 1d), somewhat larger than 1 µm diam., but never reaching 2 µm diam. The capillitium shows Y branches of 1.5–4 µm diam., with walls up to 0.4 µm thick.

Discussion

The type and only specimen studied is a single, ill-preserved specimen, easily broken on handling. The fact that the gleba is not homogeneously coloured

suggests that the material was immature upon collecting. Under the LM the gleba also exhibits hyaline hyphal elements, possibly from the central tissue.

The specimen is characterized by its felty, very fragile peridium, presence of a distinct cellular subgleba, capillitium with medium to large pores, oblong to ellipsoid, echinulate spores under the LM, which appear with spines arranged forming cristae and greatly resembling those of *Calvatia sporocristata* Calonge (Calonge et al. 2003). The ends of the capillitium threads coincide with those of *C. cretacea* (Berk.) Lloyd and *C. horrida* M. Lange (Lange 1990). According to Kreisel (1994) the new species would belong to *Calvatia* section *Calvatia*, which contains 10 species so far. However, the spore ornamentation of our collection does not match any of these. Thus, we agree with Calonge et al. (2003) to include this new taxon within section *Sporocristata* Calonge.

On the other hand, the main differences between the new species *C. oblongispora* and *C. sporocristata* are as follows: The exoperidium of *C. oblongispora* shows two layers, an outer hyphal, and an inner one of pseudoparenchymatous structure, while in *C. sporocristata* it has only one pseudoparenchymatous layer (Table 1).

The spores are morphologically similar in both but slightly bigger in *C. oblongispora* and cylindrical (Fig. 1a), whereas they appear elliptical in *C. sporocristata* (Figs. 1b, 1c). The capillitium shows irregular and variously sized pores in *C. oblongispora*, while pores are lacking in *C. sporocristata* (Table 1).

Table 1: Primary characters differentiating *Calvatia oblongispora* from *Calvatia sporocristata.*

	C. oblongispora	*C. sporocristata*
Exoperidium	Two layers: outer hyphal, inner pseudoparenchymatous	One layer: pseudoparenchymatous
Spores	5.4–7.5 × 3.6–4.3 µm, cylindrical.	4–6 × 2.5–3.5 µm, elliptical.
Capillitium	With pores	Without pores

Less closely related but similar species include *Calvatia longicauda* (Henn.) Lloyd and *C. agaricoides* Dissing & M. Lange, both of which show an agaricoid shape with a distinct pseudostipe, two-layered exoperidium, and spores that are ellipsoid and echinulate spores but have spines not aligned in crests (Dissing & Lange 1962). A third similar species, *C. ochrogleba* Zeller, has the same morphology but produces spherical, spiny, spores without crests (Zeller 1947 Zeller & Smith 1964).

In conclusion, we consider that the combination of a two-layered exoperidium, spores with spines aligned in crests, and a pored capillitium supports the proposal of *C. oblongispora* as a new species.

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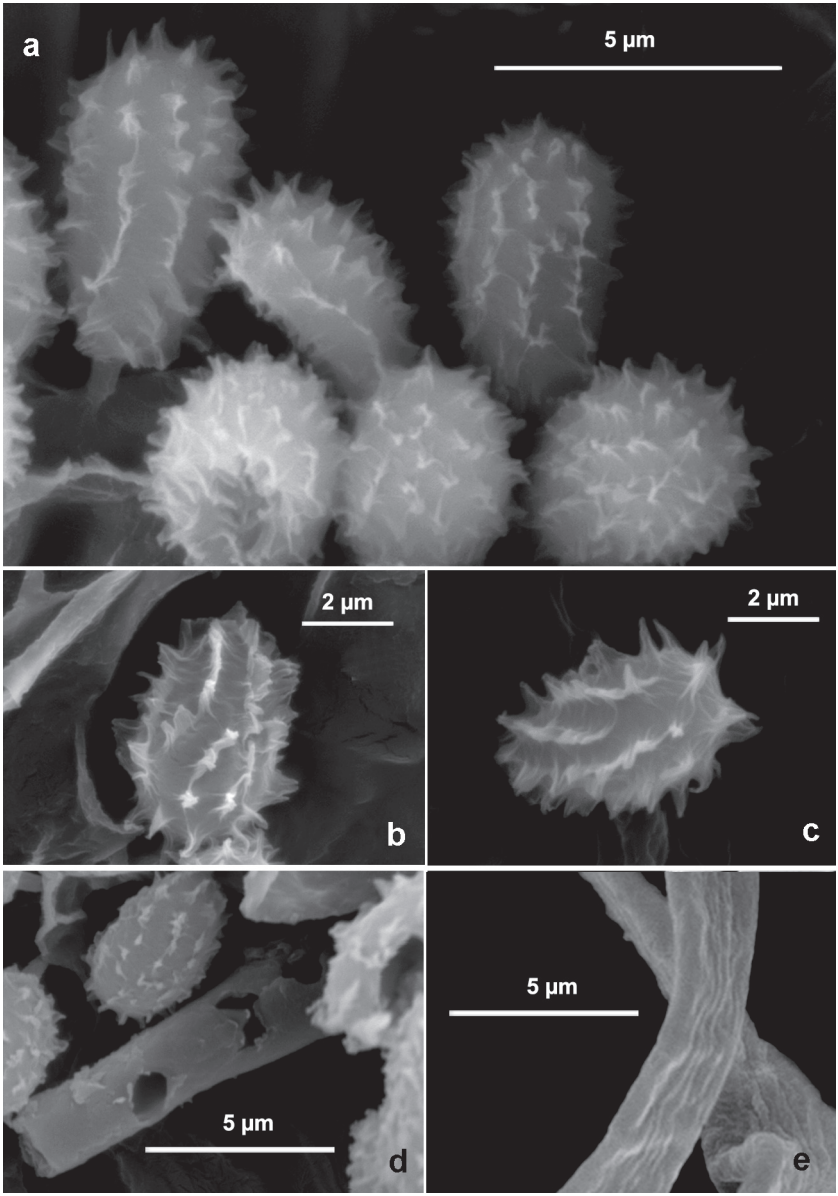

Fig. 1. **a:** *Calvatia oblongispora*. Morphology of the spores as seen under the SEM. **b, c:** *Calvatia sporocristata*. Morphology of the spores as seen under the SEM. **d:** Capillitium of *C. oblongispora* with pores. **e:** Capillitium of *C. sporocristata* without pores.